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# Foreword

Structural integrity assurance is a matter of paramount importance in the context of structures, equipment, systems and components performing their intended function over the specified life span. For large structures and high energy systems this assumes added importance in view of the potential catastrophic consequences in the event of loss of structural integrity. Over a period of time, structural integrity has evolved into a comprehensive field of research and application in important sectors such as nuclear, aerospace, petrochemicals, civil structures and many others.

With progressive research in domains of structural mechanics, assessment of structural loading under various natural as well as manmade events, joining techniques specially welding, material damage, environment–material interaction, non-destructive testing and evaluation, in-service inspection and repair, assessment of safety margins etc., it is now possible in most cases to reduce probability of major structural failures to negligible levels while at the same time ensuring greater cost effectiveness. This also involves deeper and quantitative understanding of phenomena like deformation, fatigue, creep, corrosion etc. and the related rate of damage and failure propagation.

Development of new advanced materials, material processing and joining techniques, related data base, newer inspection and imaging techniques, on line data processing capability, vastly enhanced computing power and multiple design basis criteria have all led to more balanced and competitive designs with far greater safety assurance.

Availability of high resolution non-destructive inspection methodologies along with robotic manipulators and their deployment during manufacture more particularly during welding processes, construction and erection, pre-service inspection to establish a base line etc. have made a significant impact on our ability to monitor and track the state of health of a structural element. Comprehensive documentation of such inspection forms the key data base input for life management programs.

In India, we have gathered comprehensive experience in dealing with new and old designs of nuclear power plants with extensive life management exercises, some of which were first of their kind. Our ability to ensure and demonstrate structural integrity in spite of coming to light of new phenomenon like hydride blistering in in-core zirconium alloy pressure tubes has enabled continued operation of our Pressurised Heavy Water Reactors (PHWRs), while these tubes were being progressively replaced in a phased manner. This has meant extended utilization of our capital assets resulting in significant avoidance of economic losses.

Similar developments in the context of structural integrity assurance are taking place in several other key sectors of economy such as offshore, petrochemicals, aerospace, power and transportation.

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The First International Conference on Structural Integrity (ICONS 2014) organized by Indira Gandhi Centre for Atomic Research at Kalpakkam in association with the Society for Failure Analysis, The Indian Institute of Metals and The Indian Institute of Welding, during February 4-7, 2014 was thus a major platform that brought together a large number of researchers and practitioners from wide multidisciplinary and geographical domains. Sharing of research findings, work experience and cross fertilization of ideas that take place in such events is in itself a major contribution to the field. Guest editors T. Jayakumar, R. Sandhya, B.P.C. Rao and A. K. Bhaduri have painstakingly compiled these proceedings in the form of selected papers following the due rigorous review processes which, I am sure would be very valuable reference material for engineers and scientists working in this area.

Anil Kakodkar

Former Chairman,
Atomic Energy Commission, India